ISIS – Innovative Solutions In Space

Launch results from the QB50 pre-cursor launch campaign flight qualification of the QB50 launch system

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2014 CubeSat WorkShop, Logan, Utah

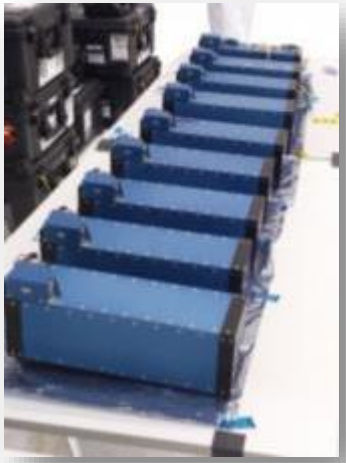
ISIS group - overview






- Founded in 2006, spin-off from Delfi-C3 project
- Currently about 50 staff (FTE)
- Provider of small satellite products and services
- Vertically integrated small satellite company
- Offices in Delft, The Netherlands and Somerset West, South Africa
- ISIS directly involved in 11% of all satellites launched in 2013 through its launch services and dispenser systems.

ISIlaunch Launch Services

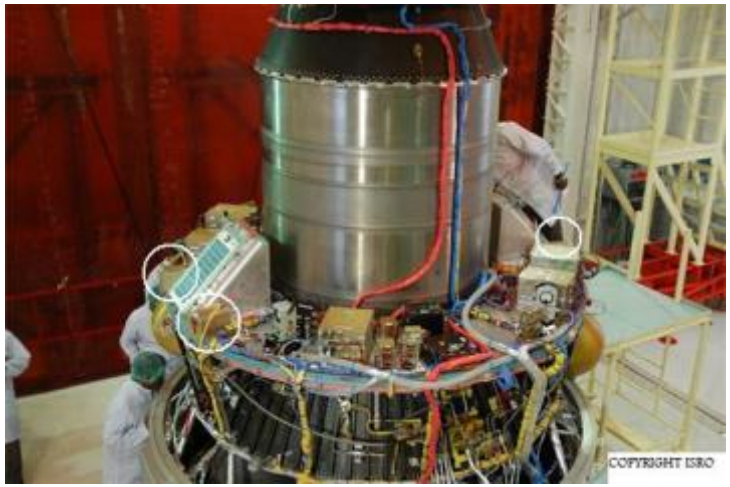


2009 - PSLV-C14 [ISILaunch01]

VEGA VV01

PSLV-C20

Antares 110



2013 -BION-M No.1 [ISILaunch02]

VEGA VV01

PSLV-C20

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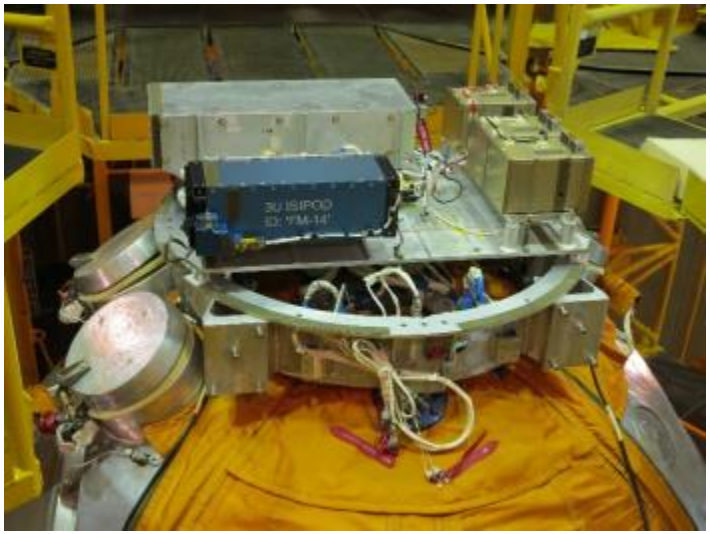

2013 - VEGA VV02 [ISILaunch06]

VEGA VV01

PSLV-C20

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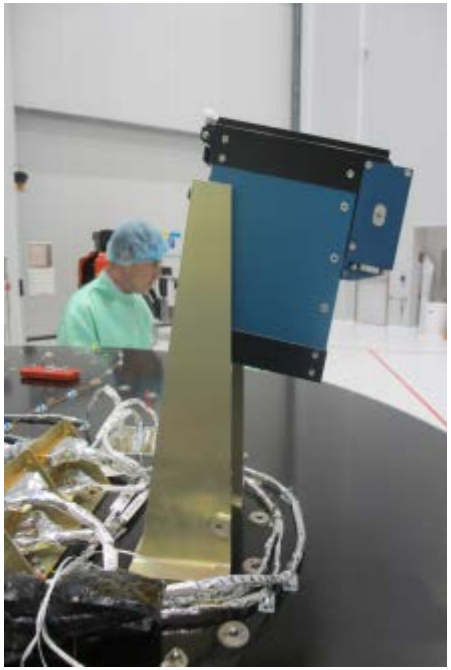
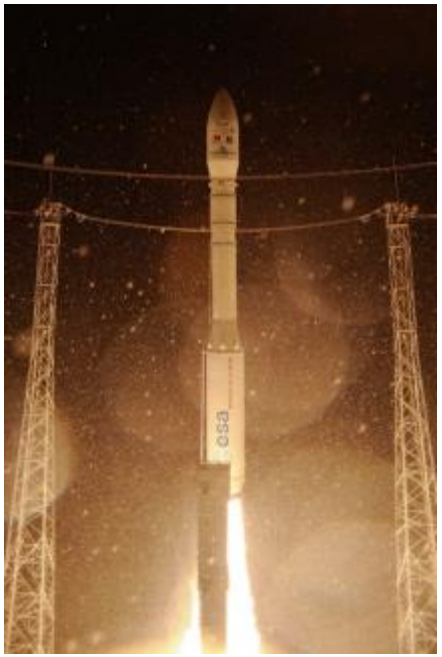


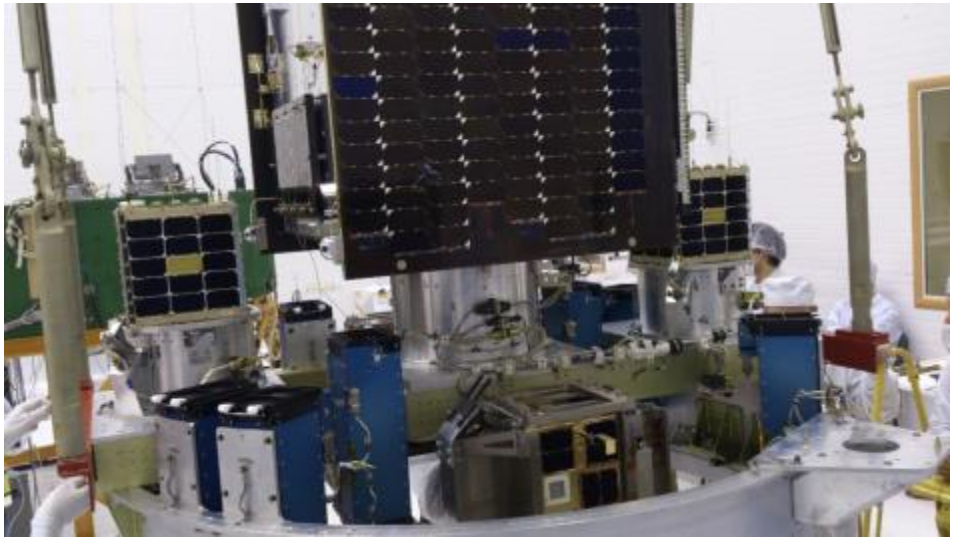


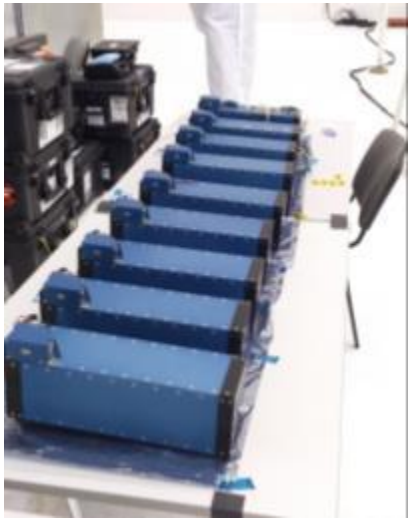
2013 - DNEPR-2012 [ISILaunch03]

VEGA VV01

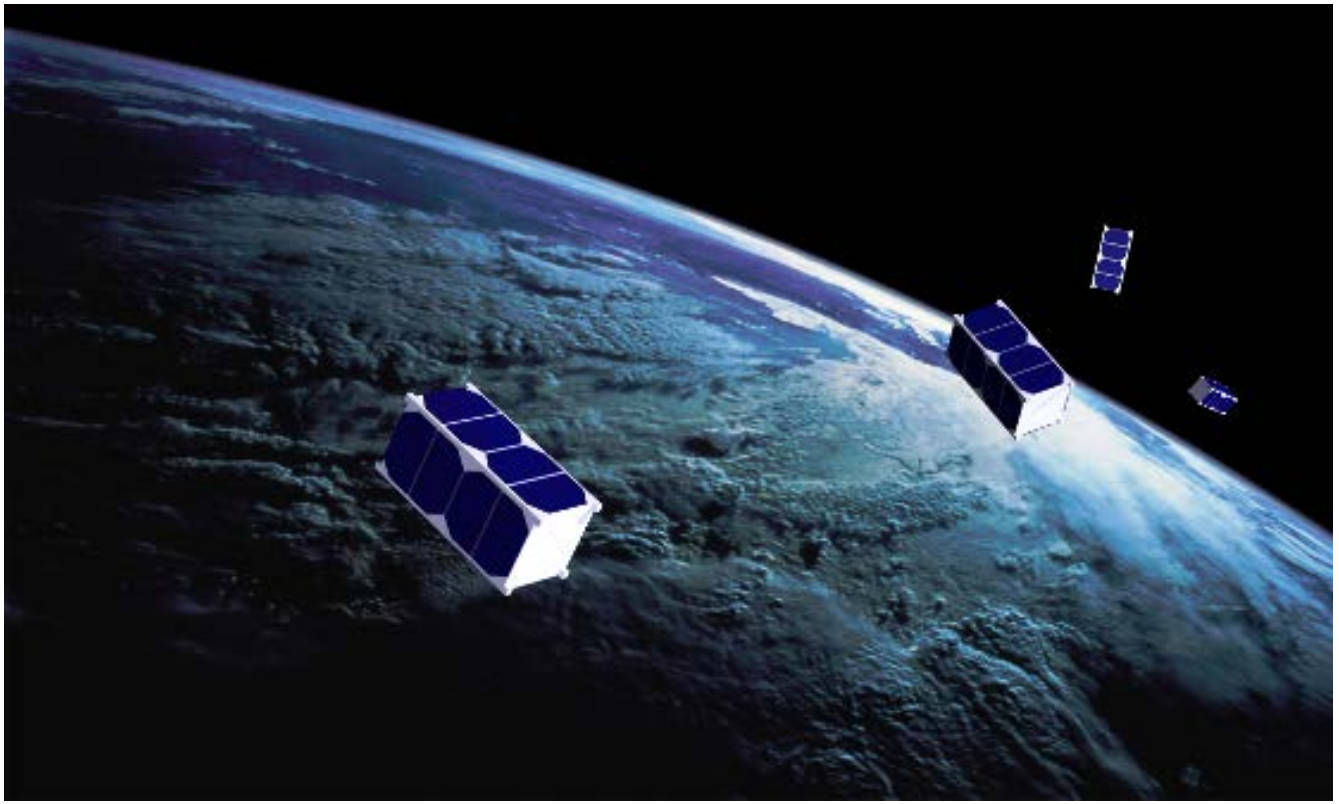
PSLV-C20

Antares 110



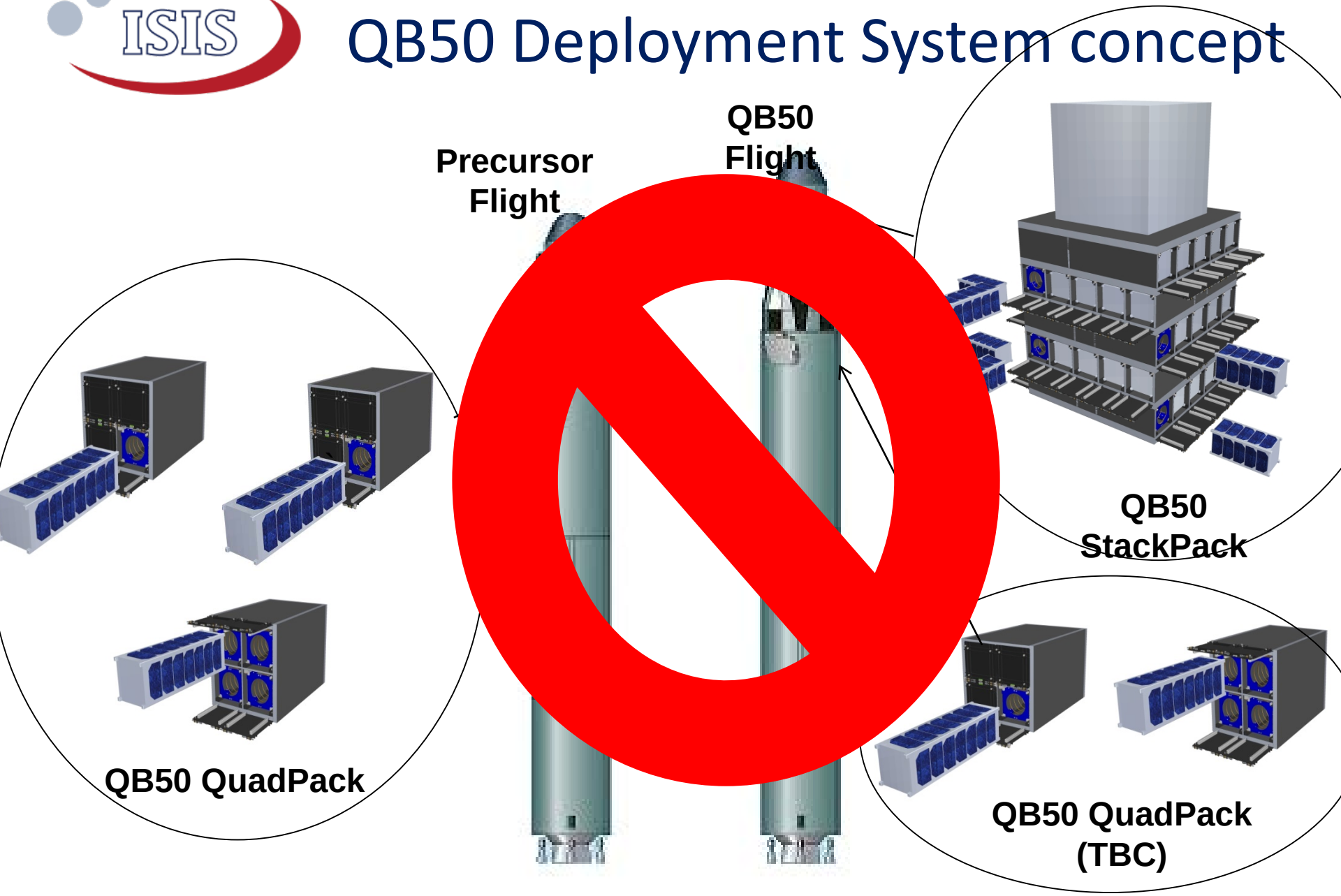


QB50 mission



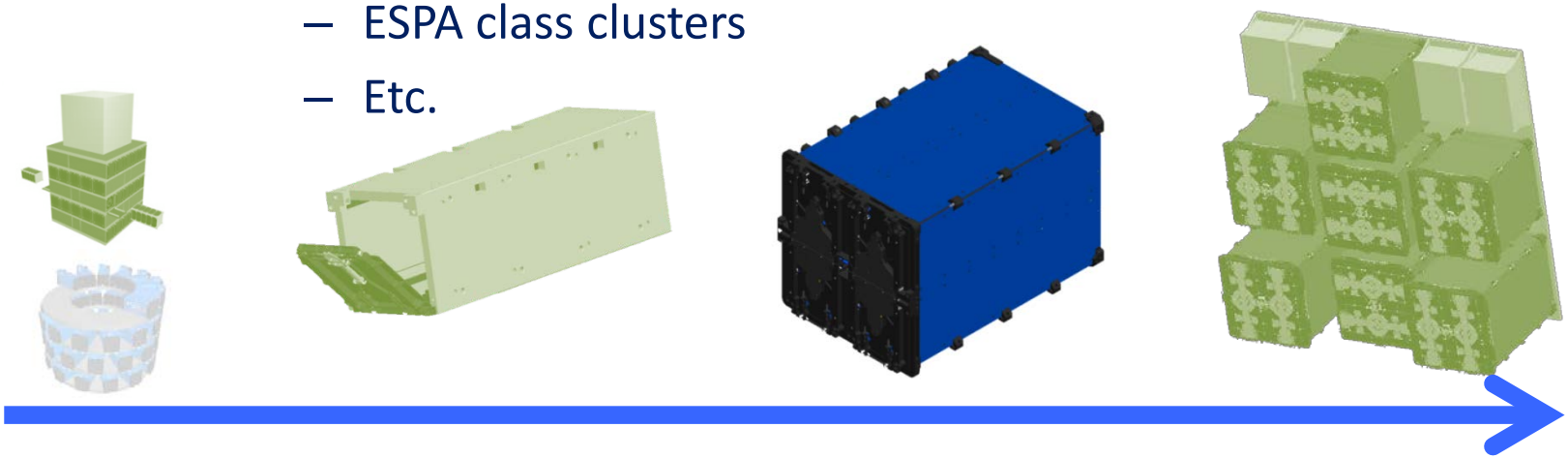
- An international network of 50 double CubeSats for multi-point, in-situ, long-duration measurements in the lower thermosphere and for re-entry research
- A network of *50 double CubeSats* sequentially deployed (1 CubeSat every orbit)
- Initial altitude: 320 km (circular orbit, i=79°)
- Downlink using the Global Educational Network for Satellite Operations (*GENSO*)

QB50 Deployment System concept



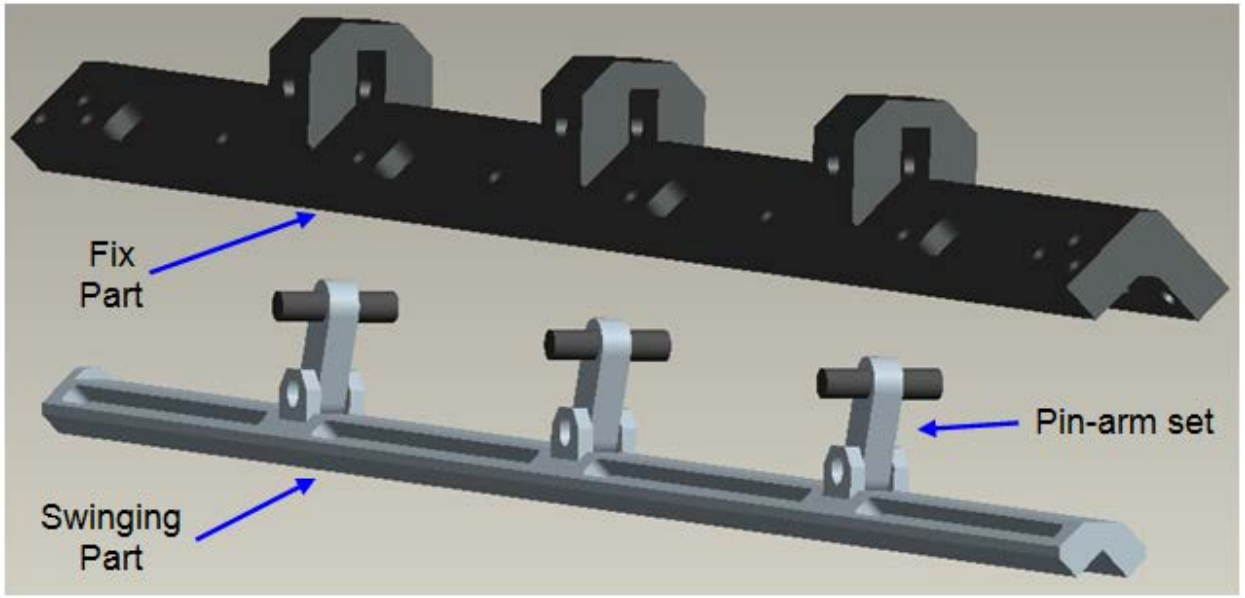
From QB50 to generic solution

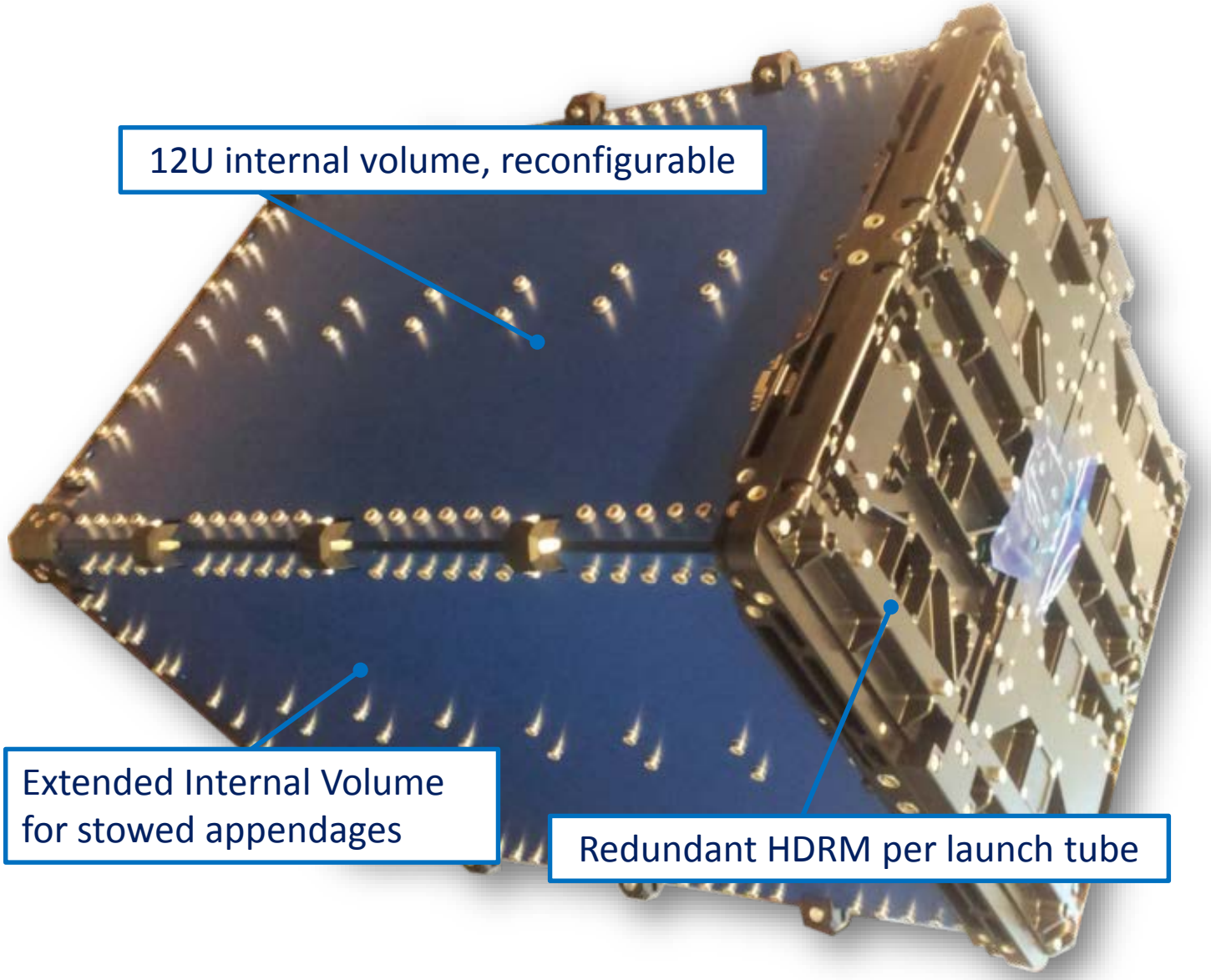
- Focus on a modular system
- Standardized interfaces
- Compatible with a broad range of launch solutions
  - Nanolaunchers
  - Piggyback
  - Cluster Launches
  - ESPA class clusters
  - Etc.



The QuadPack building block

- Scalable, Flexible, Modular
- Mounting in various orientations
- High Payload Mass (2kg per ‘unit’)
- Lightweight: < 2 kg / 3U launch slot
- Add dynamic rail to remove rattling





ISIS 12-Unit Quadpack CubeSat Dispenser

Single launch vehicle interface, highle reconfigurable payload accommodation

Quadpack Specifications

Dispenser Mass: 7.5 kg
Single Mech Interface to LV
Standard Electrical Interface
Redundant HDRM per door
Telemetry channels available
Qualified for most LVs

Payload Accommodation

Max payload mass: 24 kg
Max volume: 12-Unit

- 1 x 12-Unit CubeSat
- 2 x 6-Unit CubeSat
- 4 x 3-Unit CubeSat
- 12 x 1-Unit CubeSat
- Any combination

Custom versions possible

- 6-U CubeSat variants
- Spherical Probes
- 2U*2U*2U (8U) option
- Etc.

First Flight: 19th June 2014

QuadPack Variants

Figure 1-5: Type 3 with one 6U & two 3U CubeSat dummies

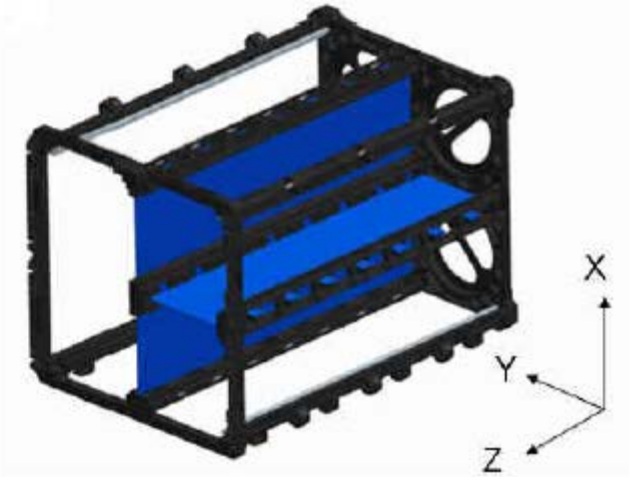


Figure 1-6: Type 3 empty internal view

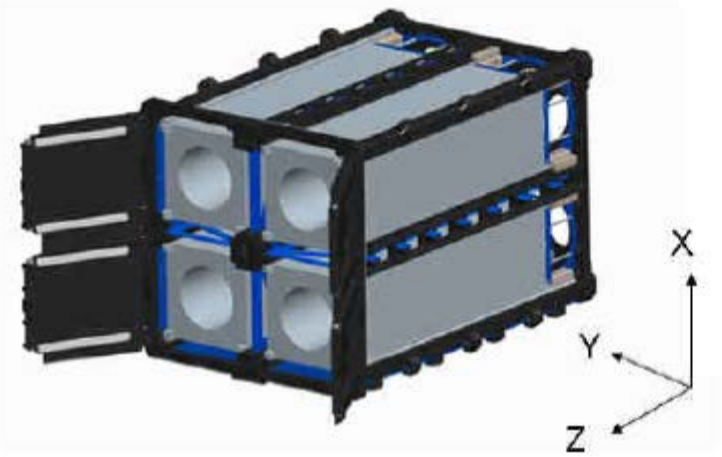


Figure 1-7: Type 4 with four 3U CubeSat dummies

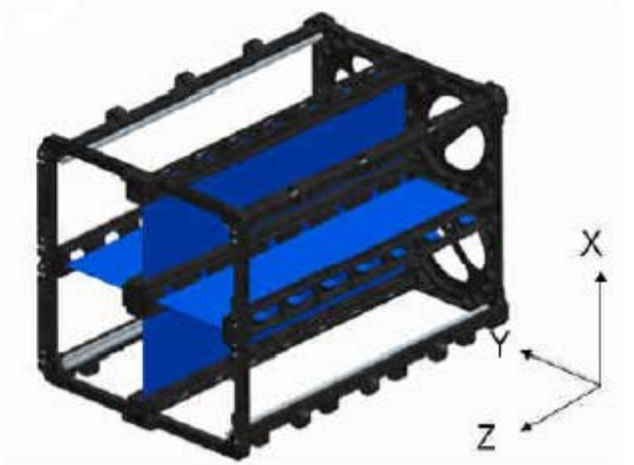
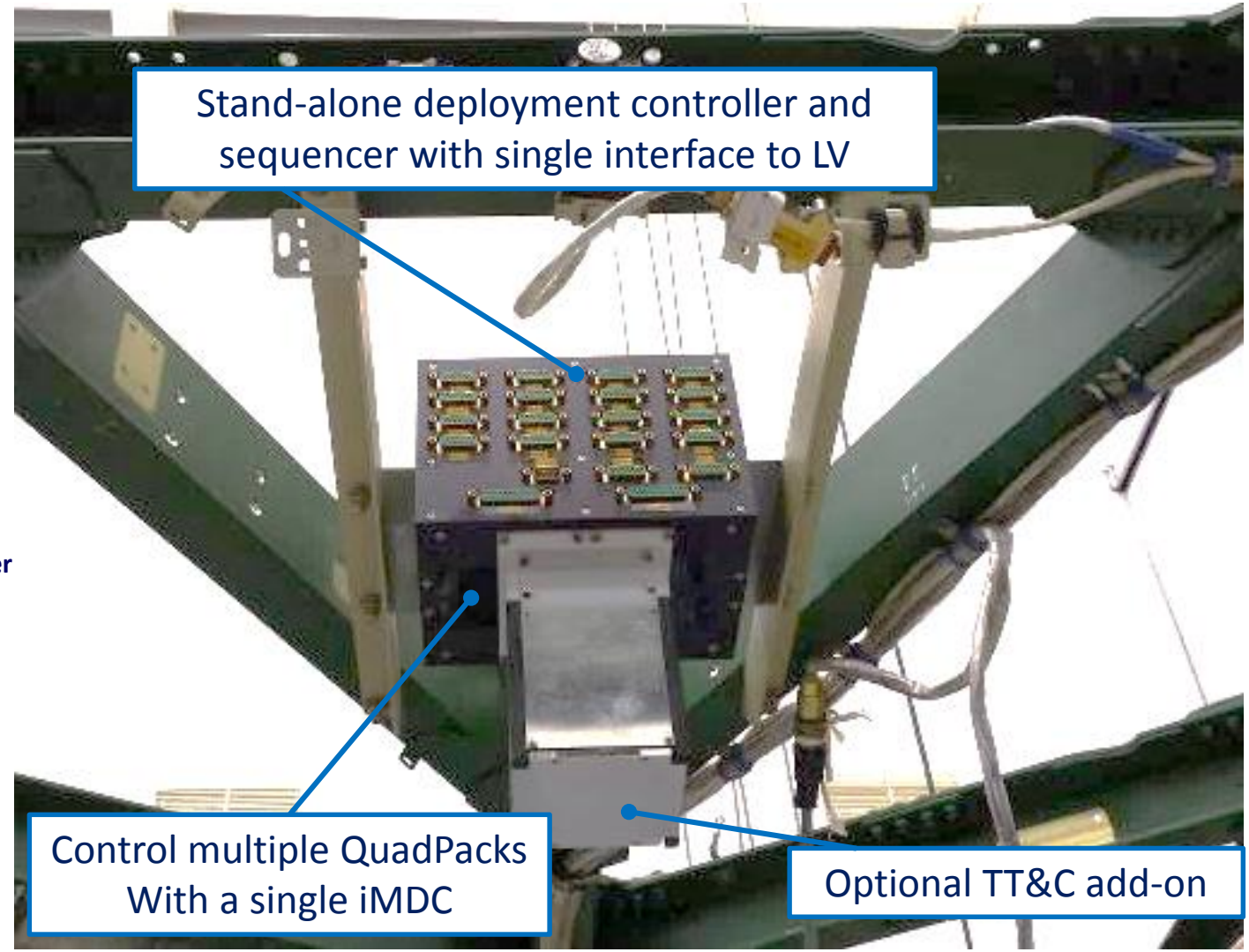


Figure 1-8: Type 4 empty internal view

ISIS Modular Deployment Controller (iMDC)

Single LV interface for deployment of CubeSats from QuadPacks



iMDC pecifications

Mass: ~2 kg

Single electrical I/F to LV

Battery powered option

Programmable Sequence

Programmable timings

Fully redundant system

Telemetry channels available

iMDCs can be linked together

Availble variants

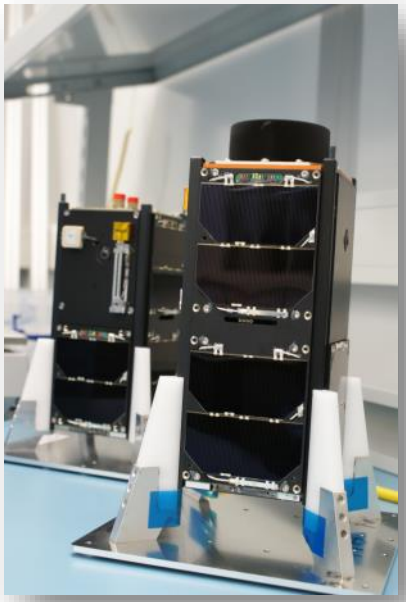
- 2 x QuadPack
- 4 x QuadPack
- 5 x QuadPack
- Etc.
- Master / Slave versions

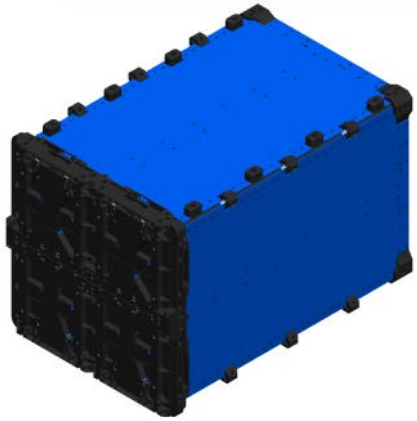
Custom versions possible

- TT&C functionality
- Etc.

First Flight: 19th June 2014

QB50 Precursor mission





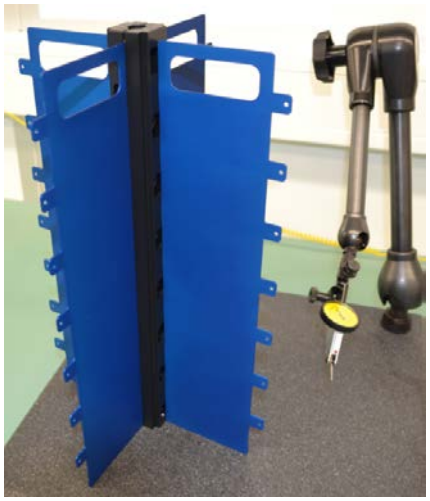
De-risk QB50 mission by:

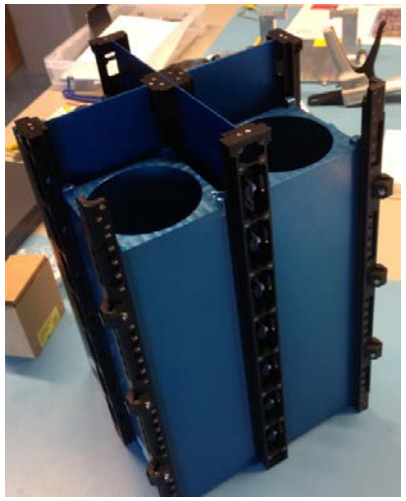
- Testing QB50 deployment system at least 1 year prior to the QB50 main launch
- Go through a ‘dress rehearsel’ with fewer satellites to test procedures for the launch campaign
- Launch two QB50 precursor satellites to de-risk other QB50 key components (ADCS, Payloads) and provide AMSAT services

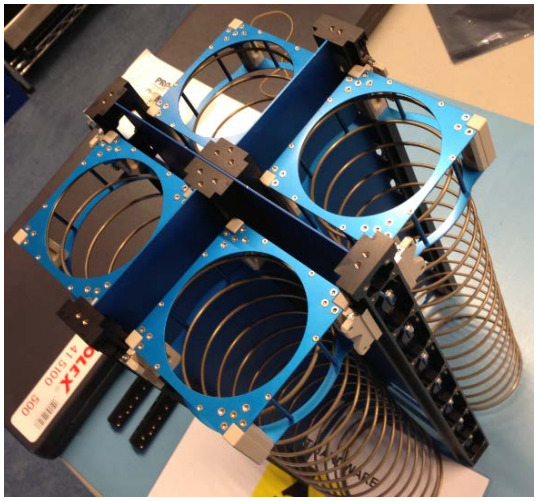
ISILaunch 07

- QB50 precursor launch integrated part of ISILaunch07
  - Total of 5 QuadPacks carrying 21 CubeSats ánd 1 large NanoSat
    - 2 x QB50 precursor satellite (2U)
    - NanoSatC-Br-1 (1U)
    - PACE (2U)
    - DTU2 (1U)
    - POPSATHIP-3 (3U)
    - DuchiFat1 (1U)
    - Flock 1c (11 x 3U)
    - Perseus-M (2 x 6U)
    - PolyItan-1 (1U)
    - BugSat1 (Nanosat)

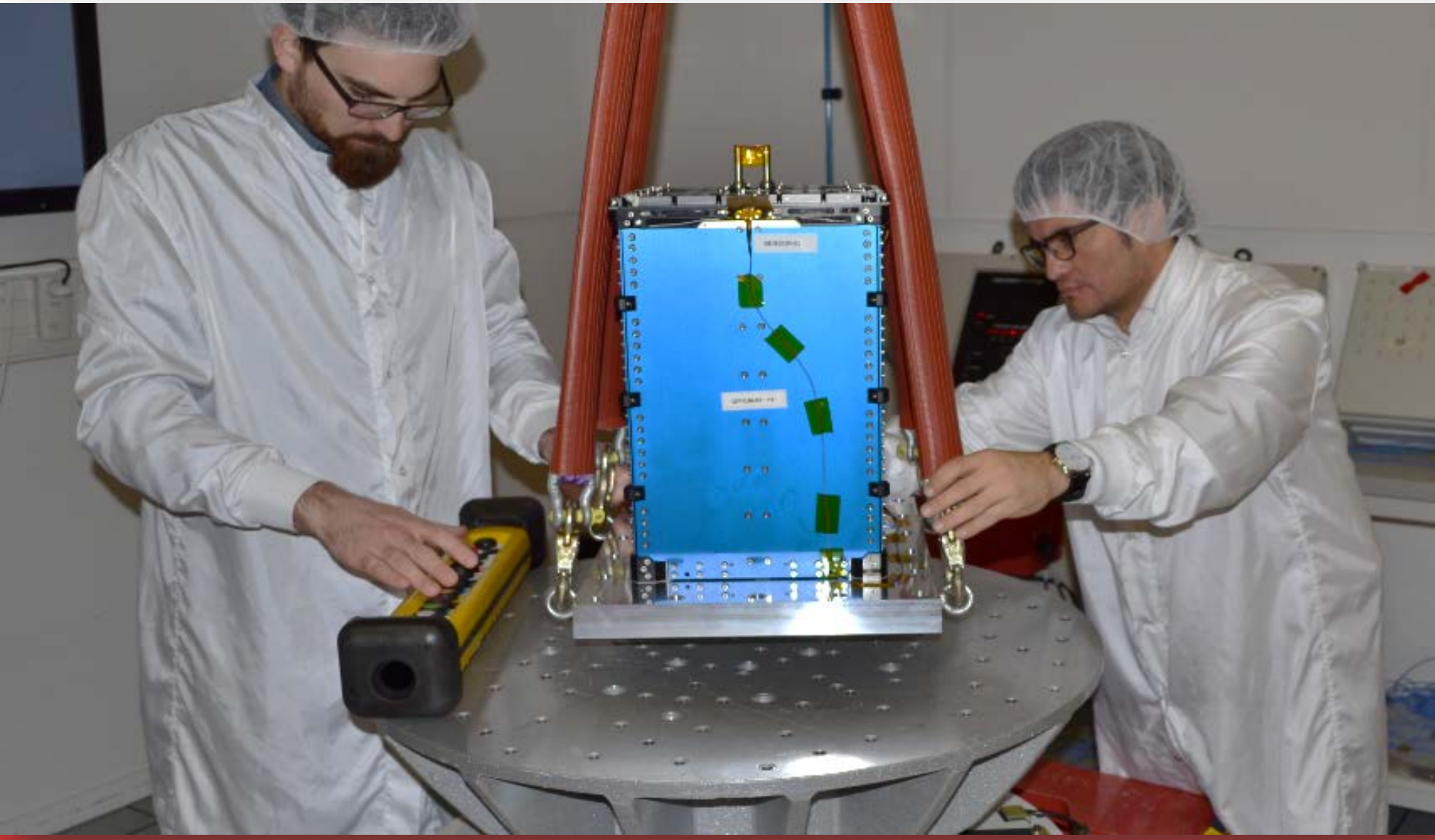
Deployment System AIT



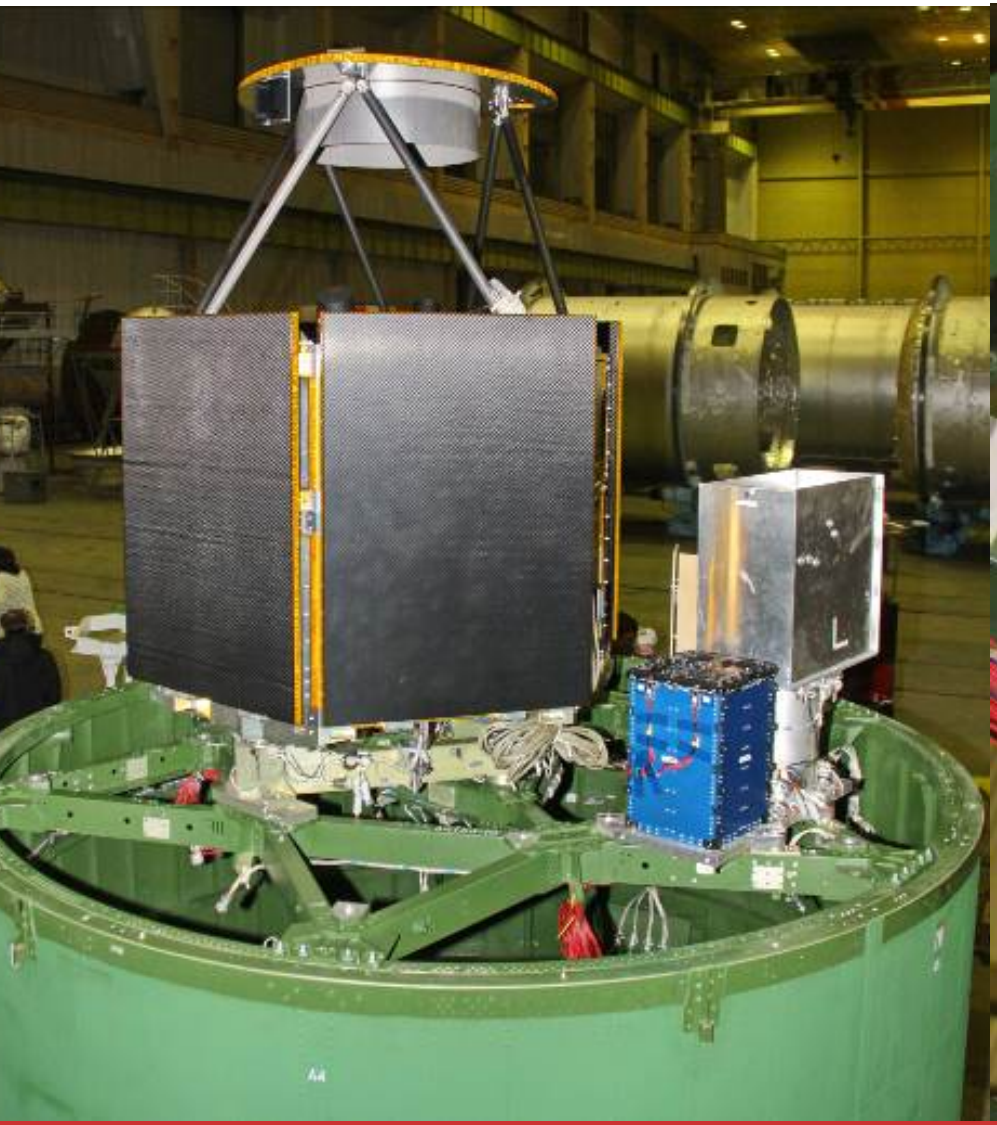


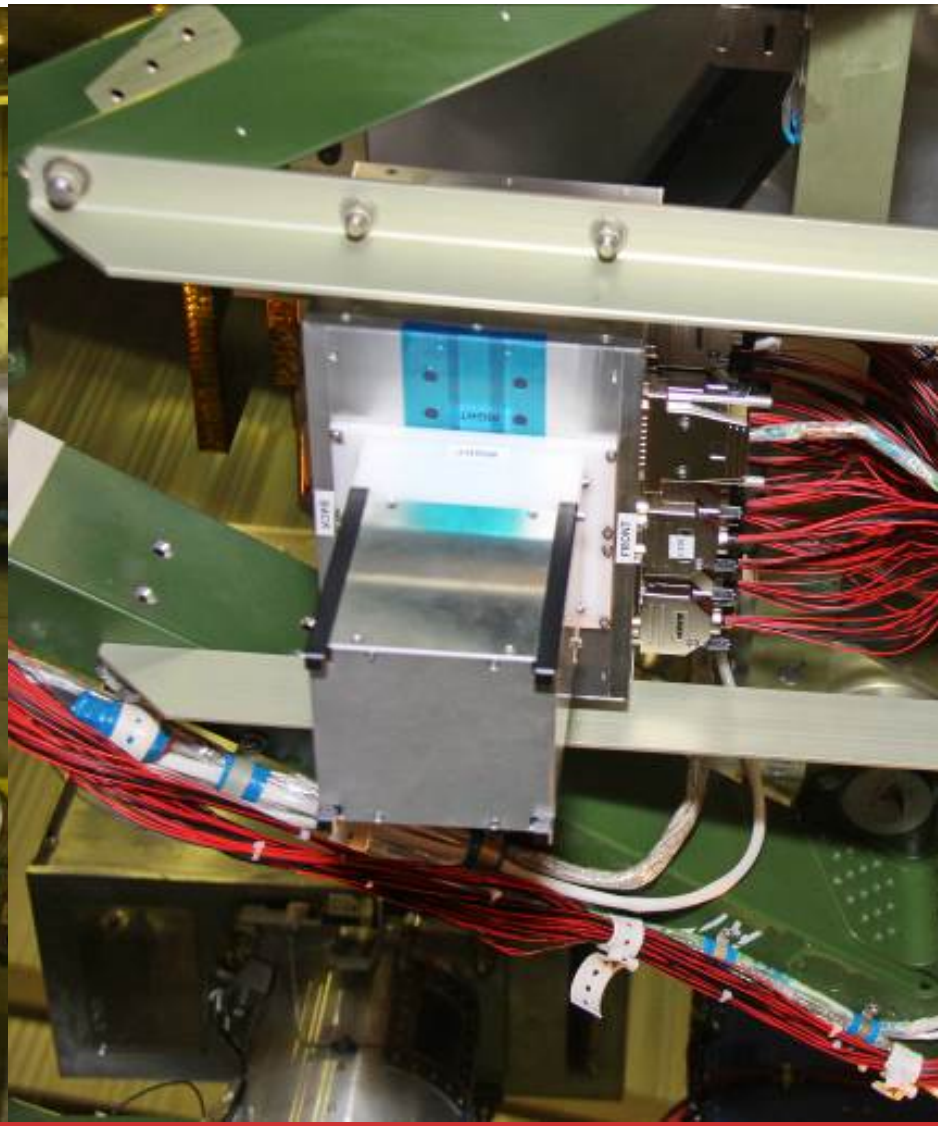


Deployment System AIT



Fit check & vibe test in Ukraine

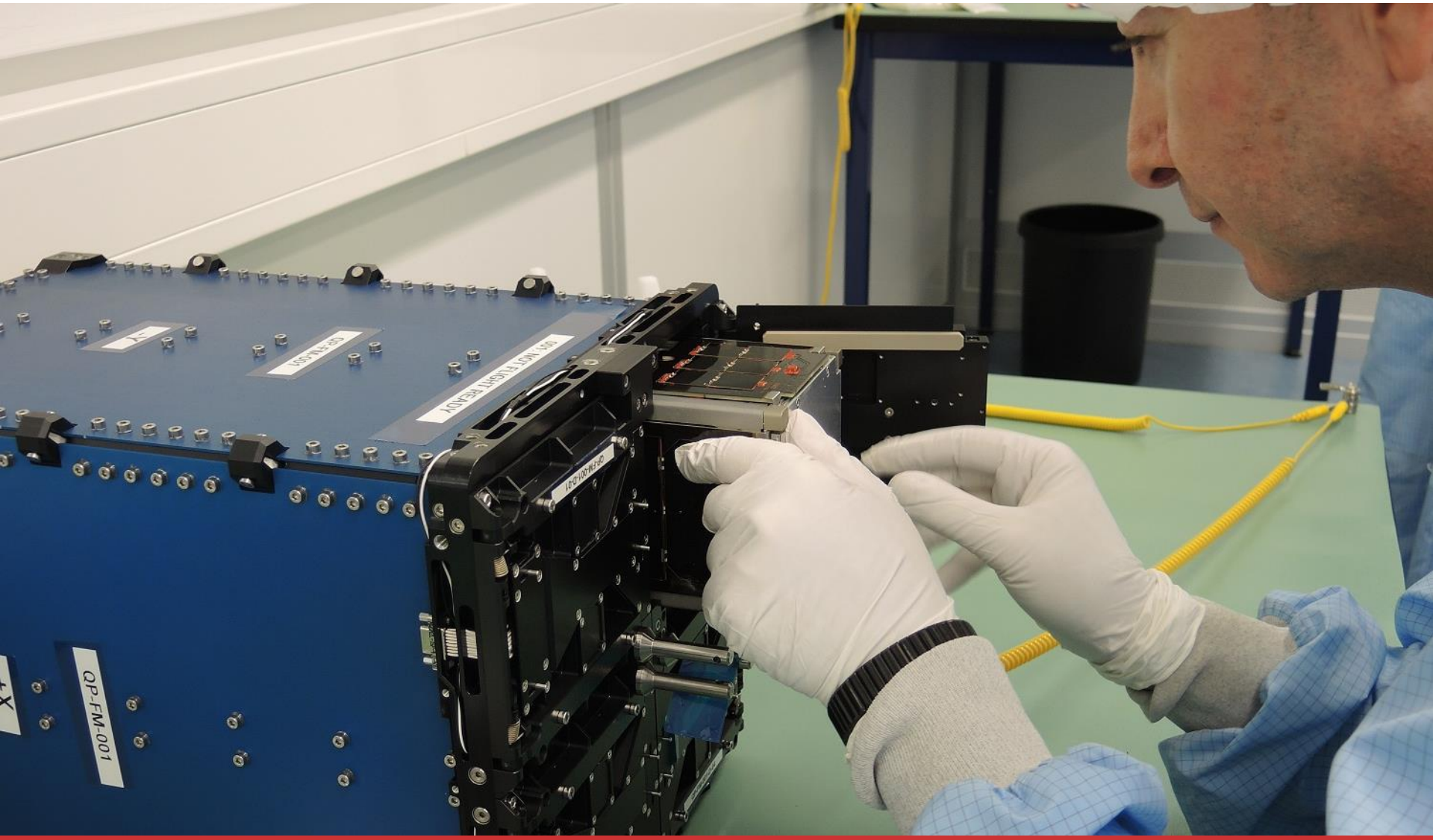




PACE Delivery in Delft

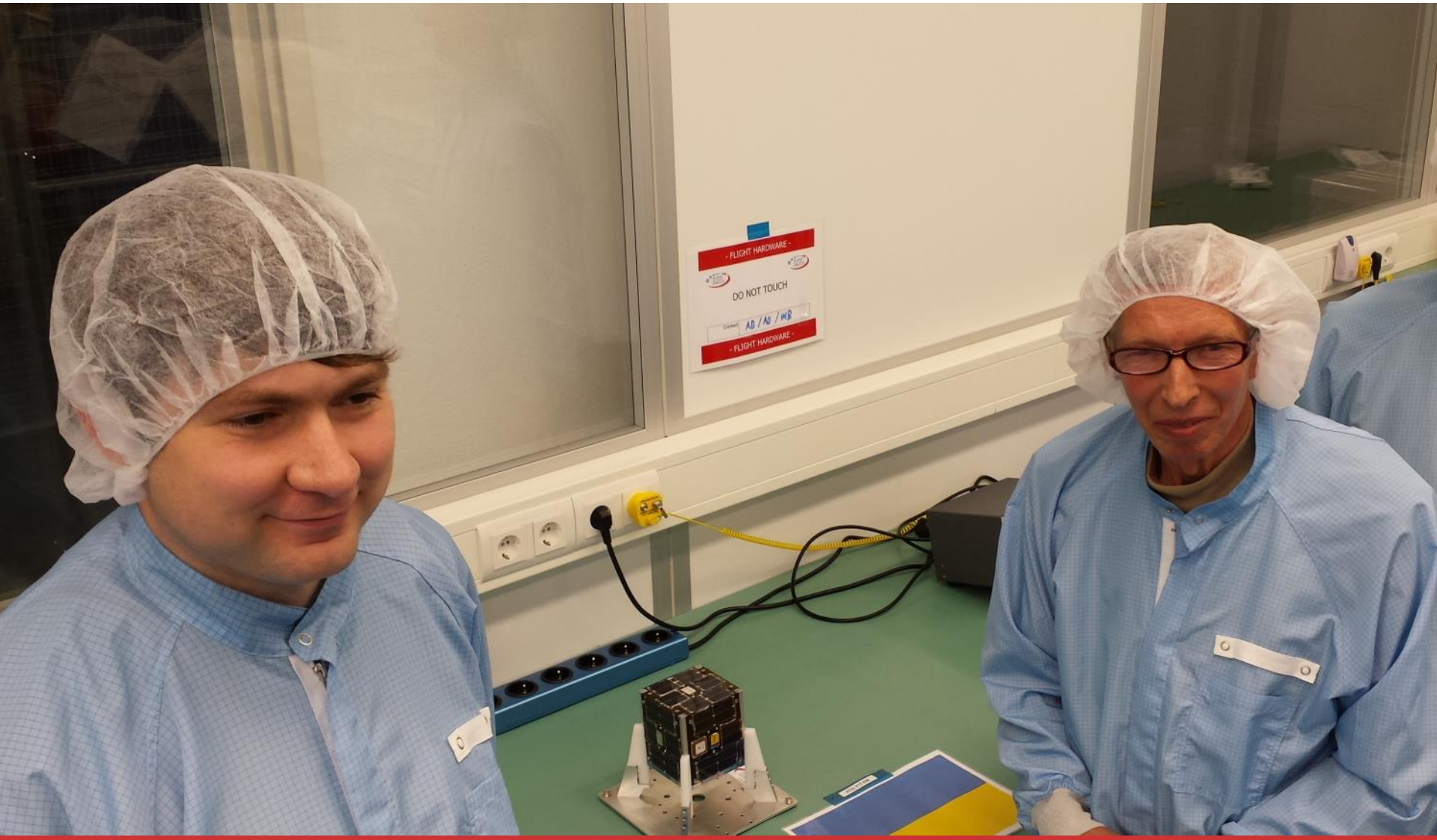
POPSAT-HIP Delivery in Delft

Duchifat Delivery in Delft



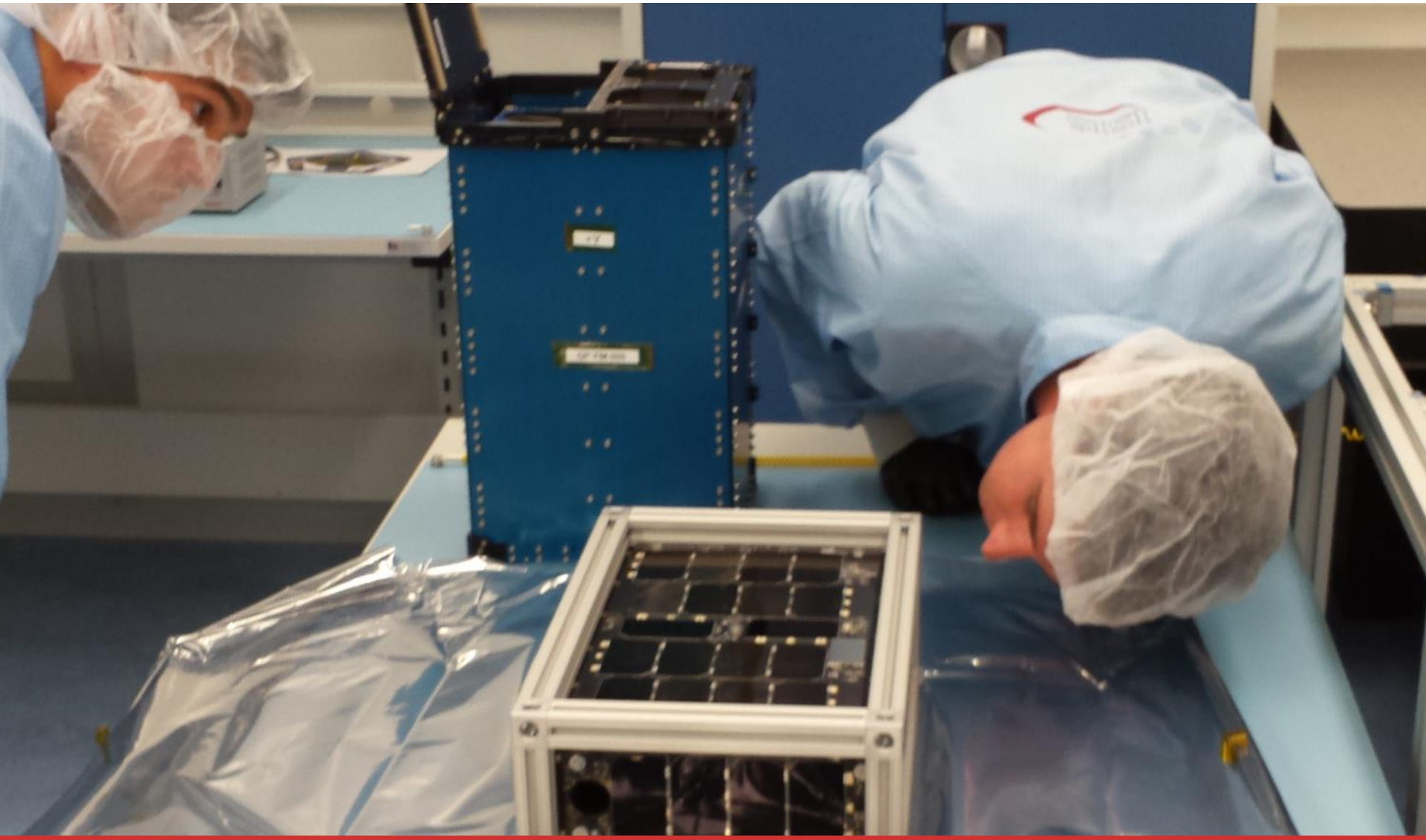
NanoSatC-Br 1 Flight Prep in Delft

Poly-Itan delivery in Delft

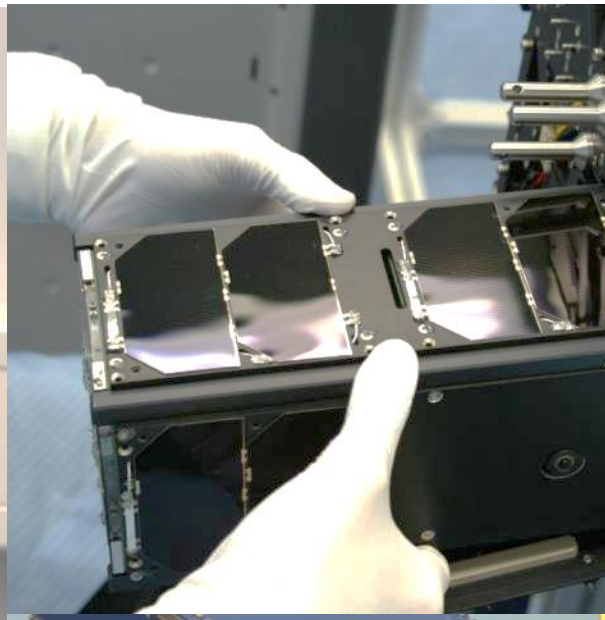


Flock 1C delivery in Delft

Perseus-M Integration in Delft



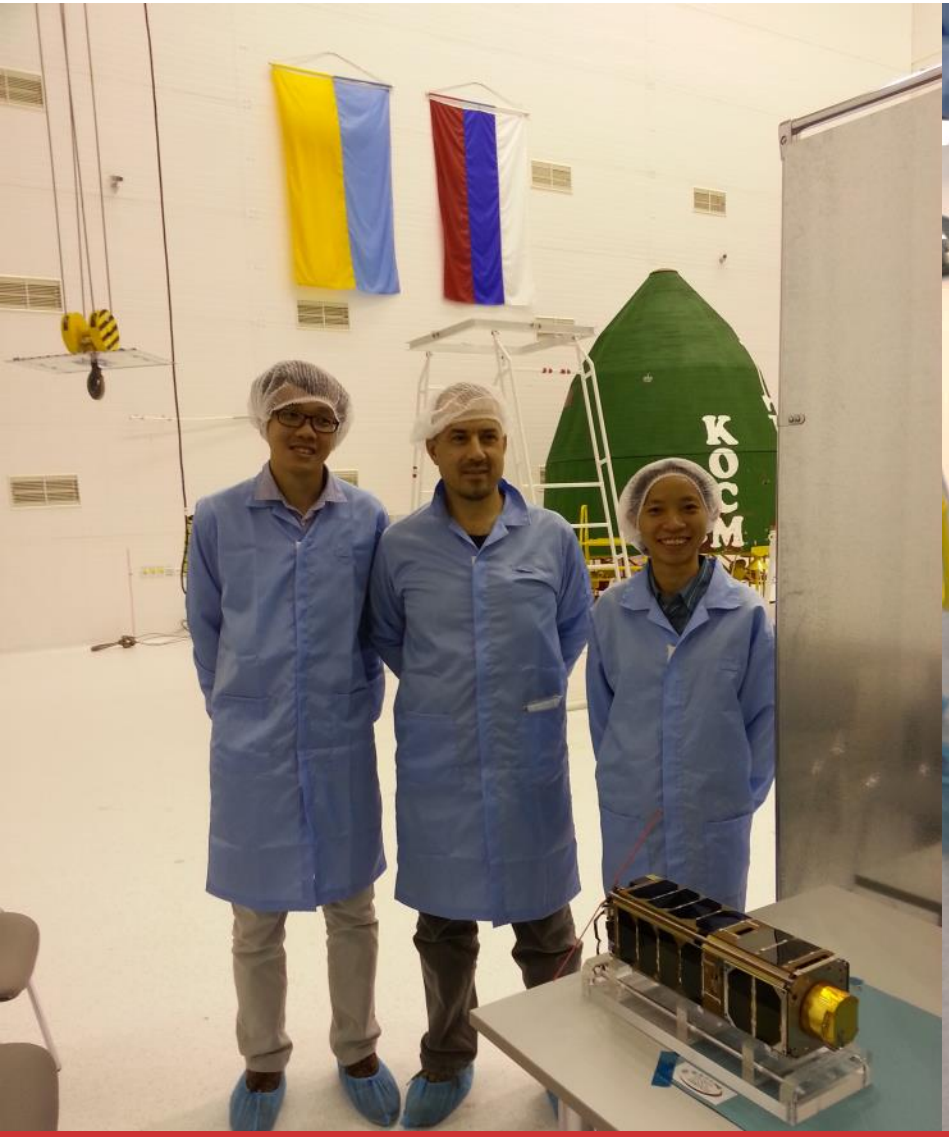
QB50 Precursor Integration

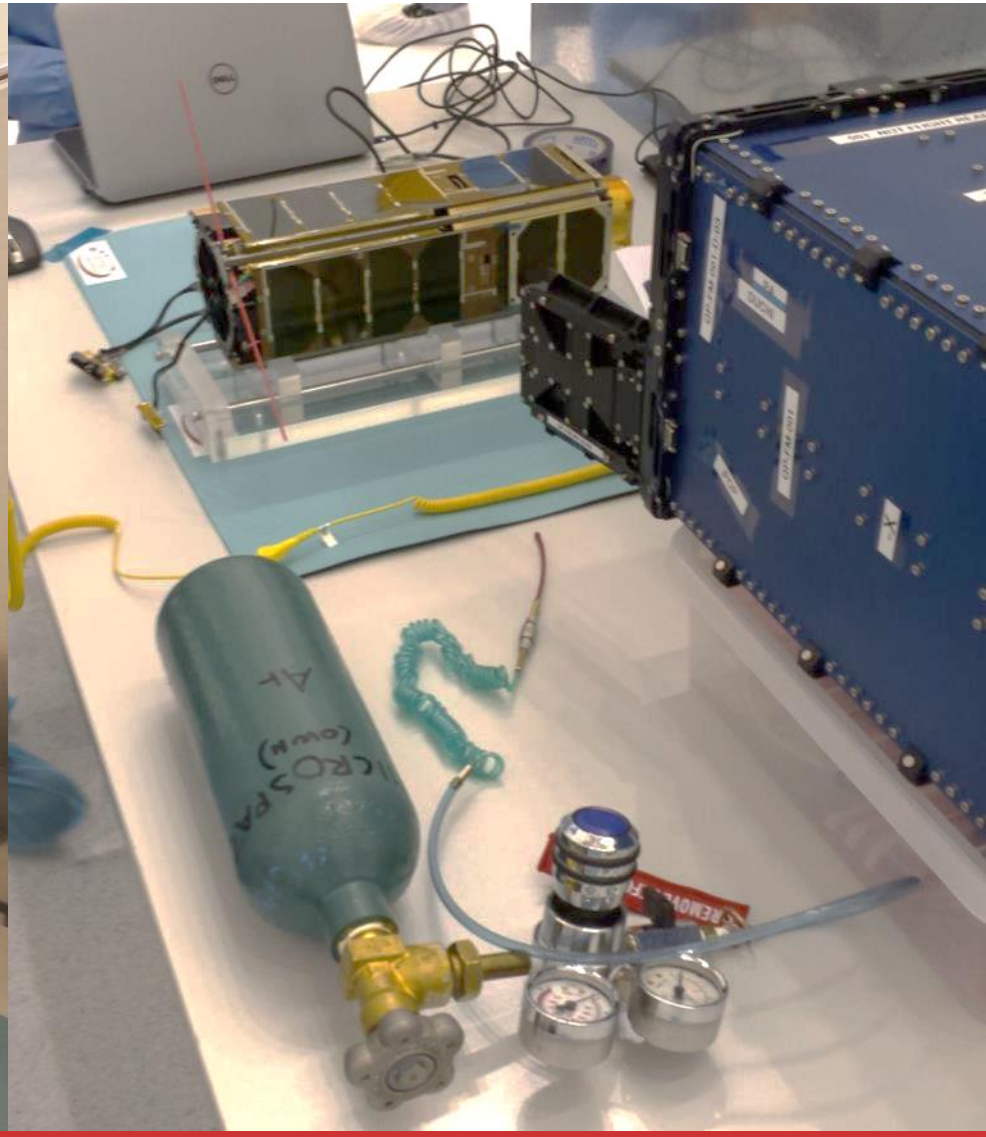


Full CubeSat manifest integrated

Transport to Yasny Launch Base

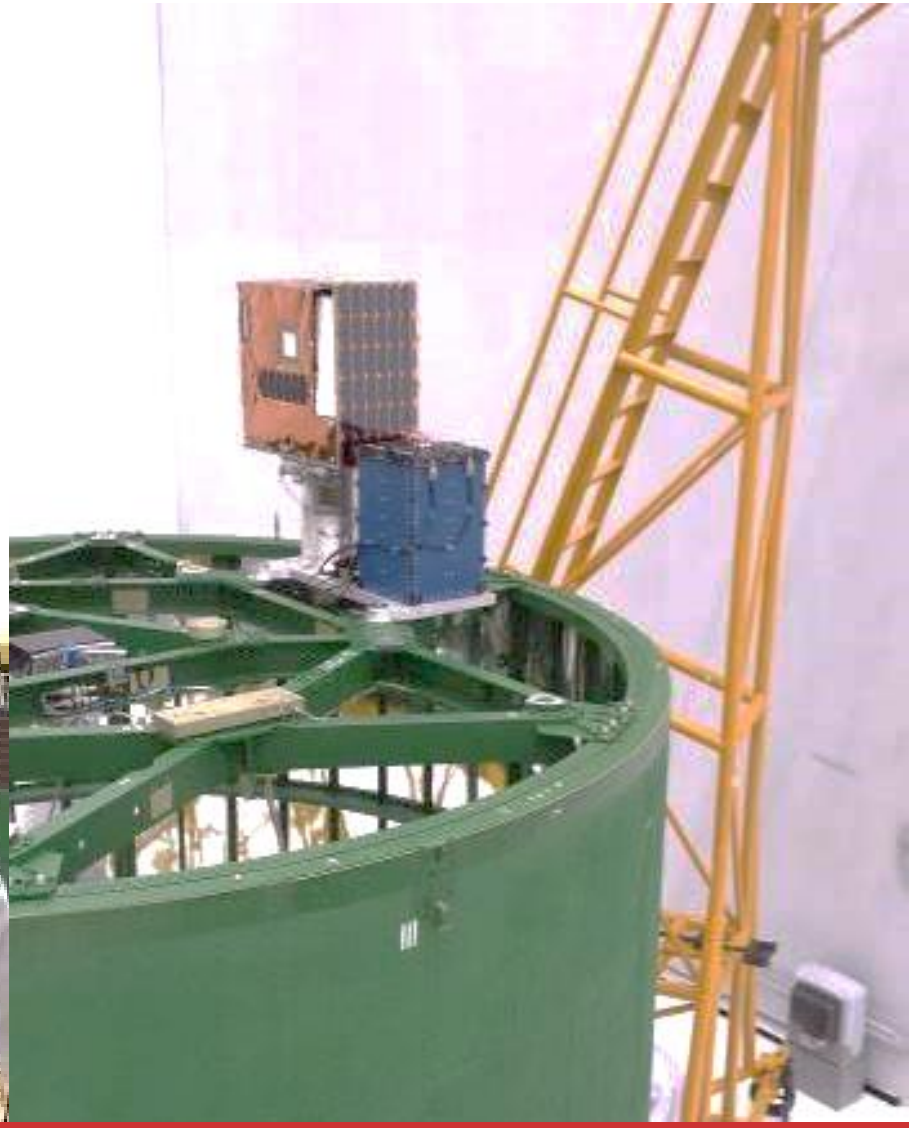
Final flight prep at Yasny





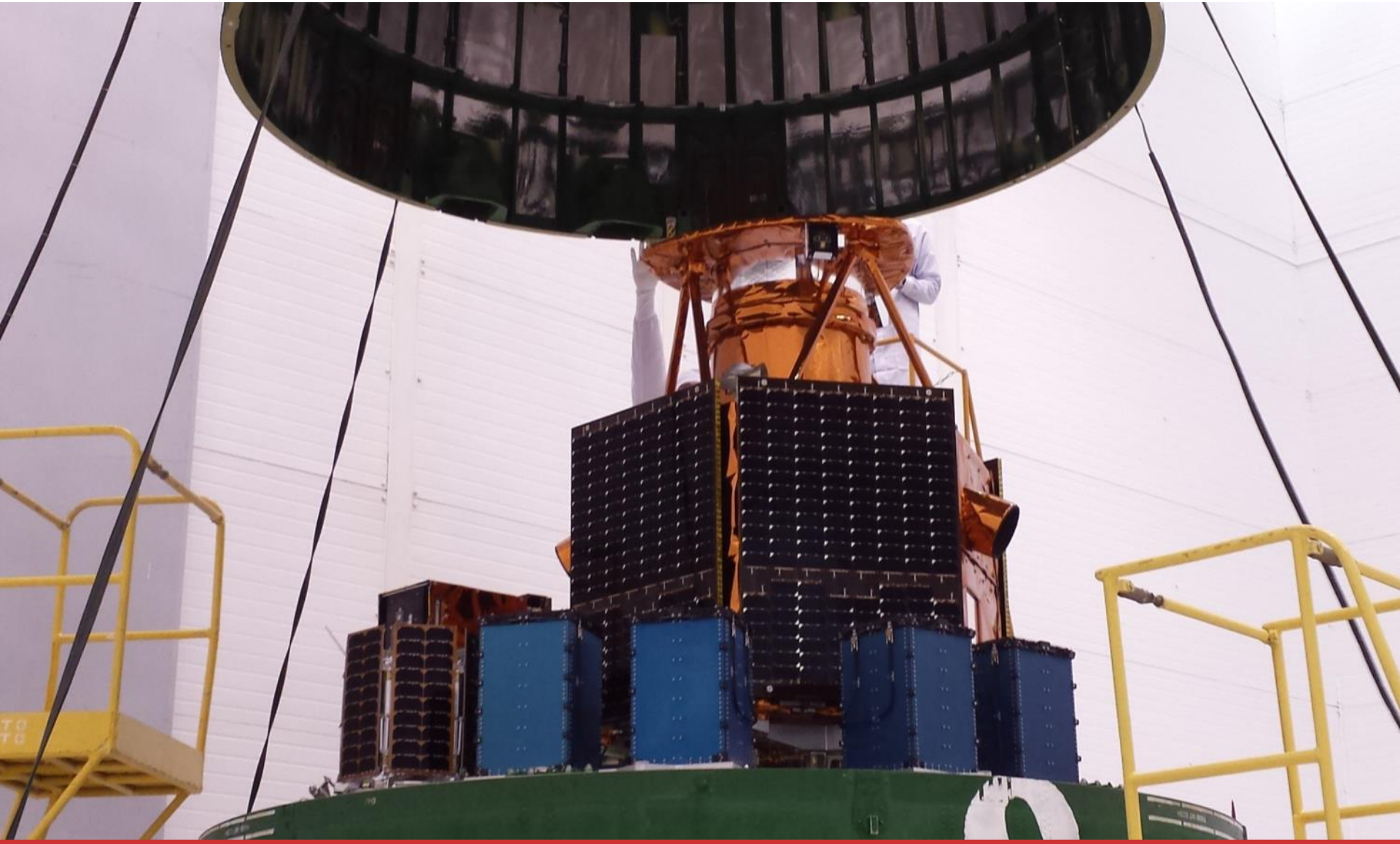
...more important things...

Integrating manifest on the SHM



Harness integration

Closing the hatch



Ready for the cluster launch

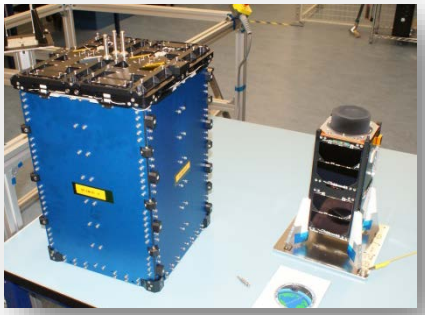
19th of June 2014 – Night Launch

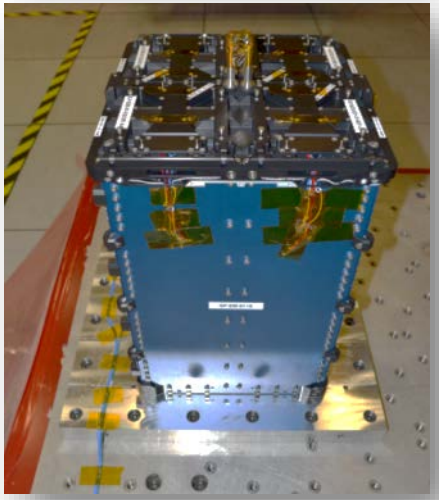
In orbit Deployment

Post Launch Results and lessons learnt

- All satellites successfully deployed
- Most satellite beacons heard within the first few hours
- iMDC / Platform tracking using network of radio amateurs very successful
- Small design improvements to implement:
  - Improvement to simplify AIT process
  - Improvement to simplify LV integration
- Options Identified to save additional mass for lower load cases

Conclusions





- QB50 Deployment System Successfully demonstrated in Orbit, all objectives met!
- QuadPack system offers flexibility towards the manifesting of different CubeSat payloads inside one dispenser type,
- QuadPack System offers great ease of integration towards launch vehicle,
- QuadPack promises to be a workhose for many CubeSat cluster launches in the coming years including:
  - Spaceflight Inc. Sherpa Launch
  - QB50 main mission
  - Various other cluster launches through ISIS' ISILaunch Services

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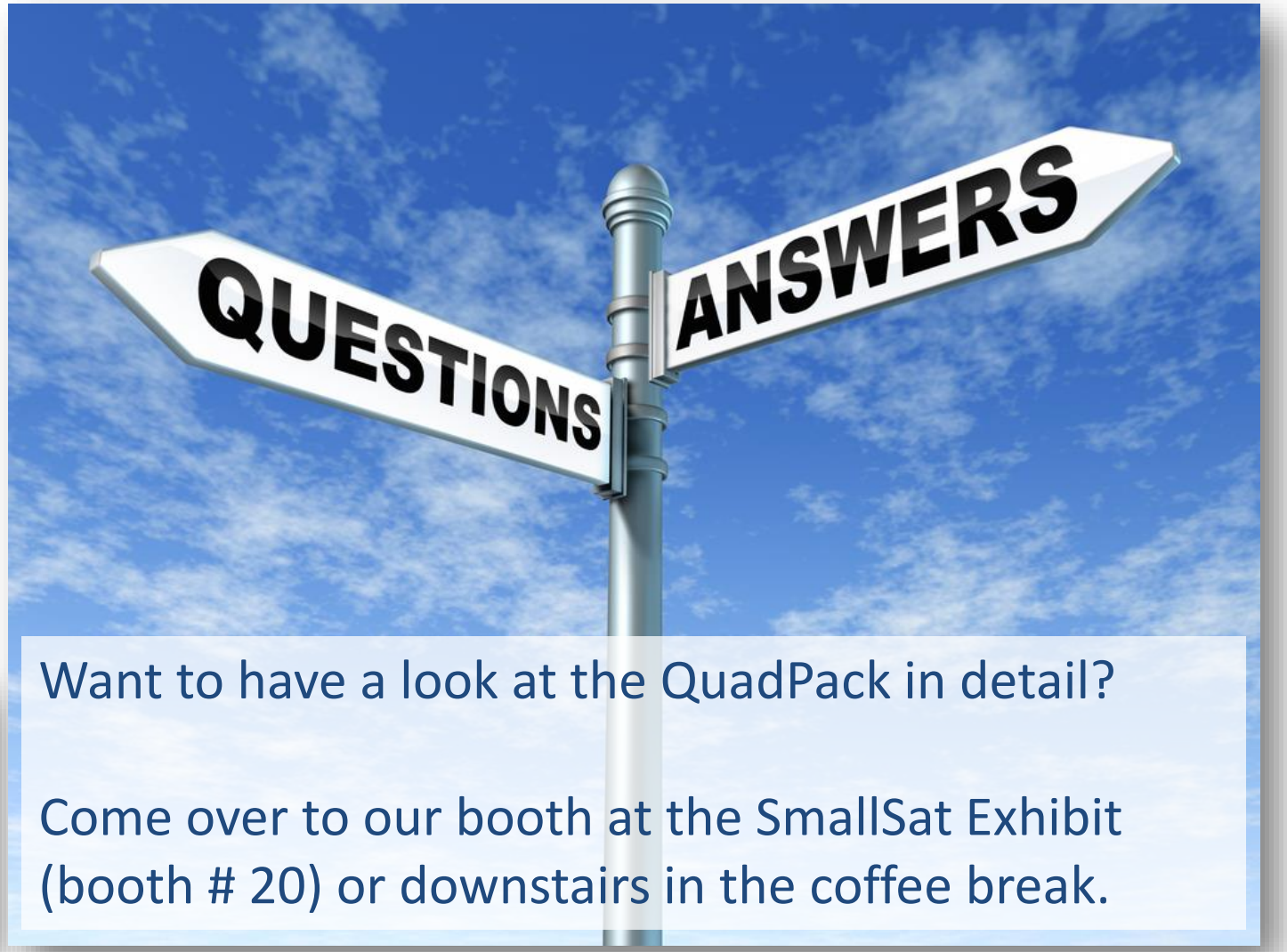

Want to have a look at the QuadPack in detail?

Come over to our booth at the SmallSat Exhibit (booth # 20) or downstairs in the coffee break.

Thank you for your attention!

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